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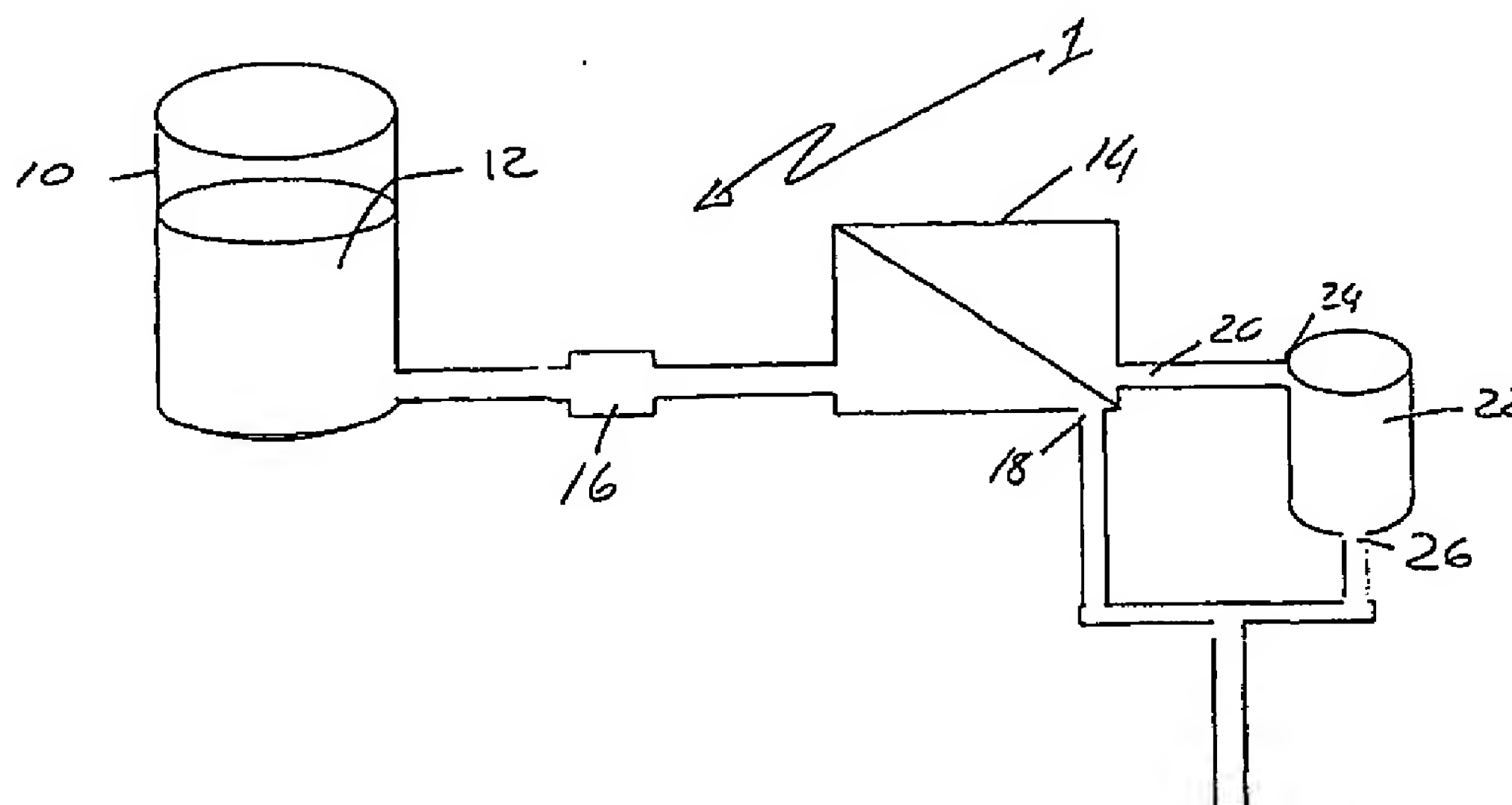
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(54) Title: APPARATUS AND METHOD FOR ISOLATING AND/OR ELIMINATING SOLUTES FROM A SOLUTION



(57) Abstract: This invention relates to an apparatus for removing solutes from a solution using a nano-filtration means to provide a treated solution.

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**APPARATUS AND METHOD FOR ISOLATING AND/OR ELIMINATING
SOLUTES FROM A SOLUTION**

15 **FIELD OF THE INVENTION**

This invention relates to the isolation and/or elimination of solutes from a solution, more particularly from beverages.

BACKGROUND TO THE INVENTION

20 It is well-known in the art that during the course of the production of certain beverages, compounds are produced which detract from the flavour and quality of the beverage. This is a particular problem associated with the production of alcoholic beverages where compounds such as ethyl acetate, acetic acid, and acetaldehyde are detrimental to the flavour and aroma of the alcoholic beverage.

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It is also known in the art that such undesirable compounds may be removed from solution by means of reverse osmosis. This process of reverse osmosis requires elevated pressures to achieve its effect, resulting in an increase in temperature. It is commonly known that certain volatile components in solution are adversely affected by an increase in
30 temperature that leads to associated unfavourable development of derivatives of integral solutes in solution, or even more unfavourably the generation of contaminating

compounds in solution. Reverse osmosis also only removes up to 15% of the volatile acidity from the wine in a single pass. If higher levels are to be removed using the reverse osmosis process, the wine has to then be passed 2-3 times which can lead to a further deterioration in the whole quality of the wine as well as excessive increases in temperature. To limit, insofar as possible, the effects of the reverse osmosis on the quality of the treated solution heat exchangers are utilised, which is costly and cumbersome.

Ultra-filtration is also known to remove unwanted compounds from a solution. However, this requires low pressure with concomitant detrimental effects to the solution insofar as desirable compounds also pass through into the permeate.

OBJECT OF THE INVENTION

It is an object of the invention to provide an apparatus, which, at least partially, alleviates the above-mentioned problems.

It is a further object of the invention to provide a method, which, at least partially, alleviates some of the above-mentioned problems.

SUMMARY OF THE INVENTION

In accordance with the invention there is provided an apparatus for removing ethyl acetate and acetic acid from an untreated alcoholic beverage comprising:

- a receptacle for the untreated alcoholic beverage;
- a nano-filtration means in fluid communication with the receptacle;
- a means for driving an untreated alcoholic beverage through the nano-filtration means to produce a retentate at a retentate outlet and a raw permeate at a raw permeate outlet, wherein the raw permeate contains an increased concentration of ethyl acetate and acetic acid;

an ion exchange column for absorbing ethyl acetate and acetic acid from the raw permeate, the ion exchange column having an inlet which is in fluid communication with the raw permeate outlet of the nano-filtration means and a treated permeate effluent outlet which is in fluid communication with the retentate outlet which, in use, combines the retentate egressing from the retentate outlet with the treated permeate egressing from the treated permeate effluent outlet to provide a treated alcoholic beverage.

Unless the context clearly requires otherwise, throughout the description and the claims, the words 'comprise', 'comprising', and the like are to be construed in an inclusive sense as opposed to an exclusive or exhaustive sense; that is to say, in the sense of "including, but not limited to".

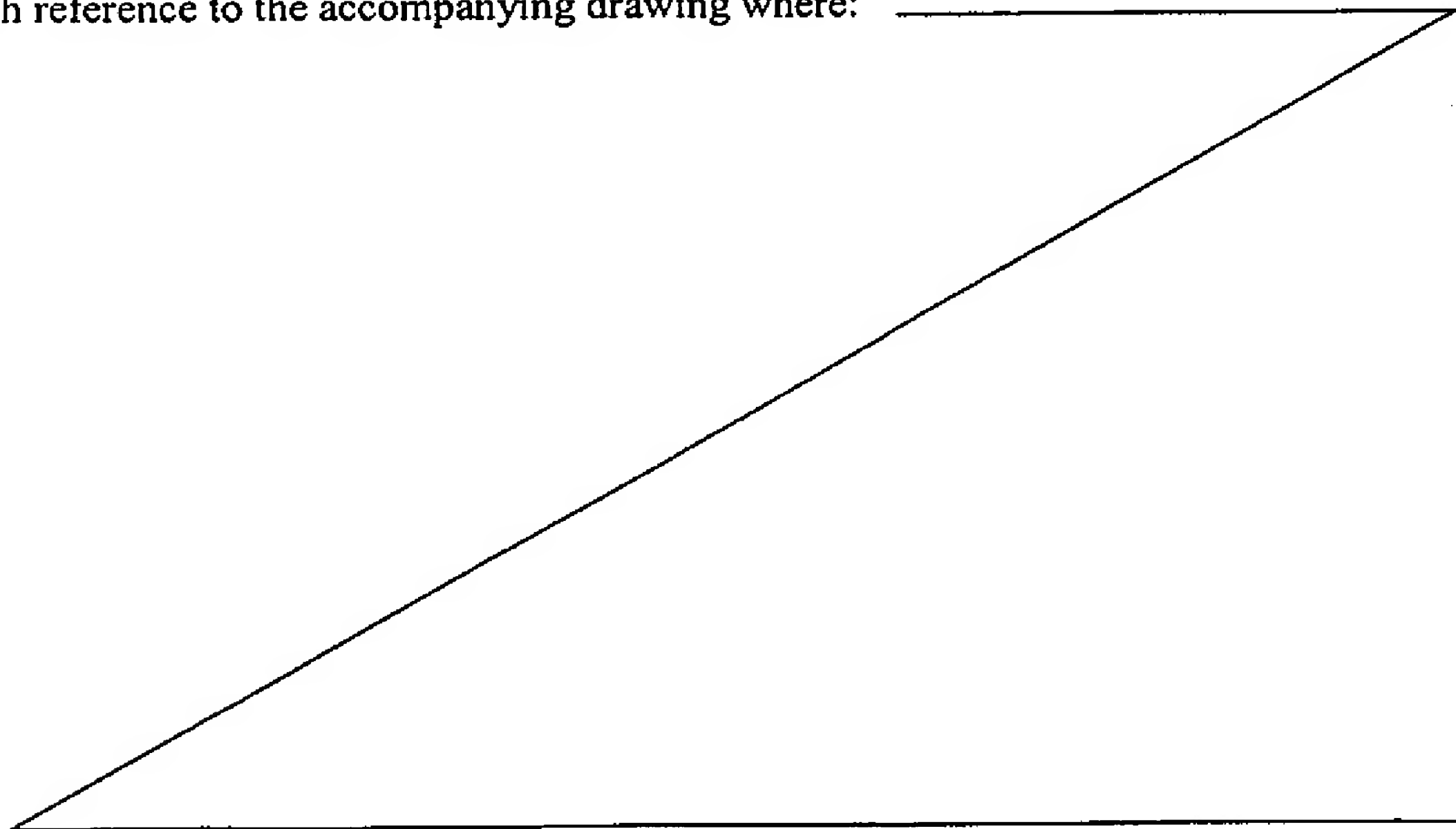
5 In accordance with this embodiment of the invention, the separation means is preferably a treatment column, the column being an ion exchange column, alternatively a hydrophobic interaction column, further alternatively an affinity column, still further alternatively a gel filtration or gel exclusion column.

Furthermore, in accordance with the invention there is provided a method for
10 treatment of an untreated alcoholic beverage to remove at least ethyl acetate and acetic acid from said beverage including the steps of subjecting the said beverage to a process of nano-filtration for producing a retentate and a raw permeate, with the raw permeate containing an increased concentration of ethyl acetate and acetic acid; treating the raw permeate in an ion exchange column for removing at least a portion of the ethyl acetate
15 and acetic acid to provide a treated permeate; and combining the retentate and the treated permeate to provide a treated alcoholic beverage.

Preferably, the treatment of the raw permeate occurs under high pH conditions on an anion exchange column.

BRIEF DESCRIPTION OF THE DRAWINGS

20 One embodiment of the invention is described below, by way of example only, with reference to the accompanying drawing where:



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Figure 1 is a schematic view of apparatus for isolating and/or eliminating a solute from a solution.

5 **DETAILED DESCRIPTION WITH REFERENCE TO THE DRAWINGS**

With reference to the drawing an apparatus (1) for removing a compound (not shown) of interest from an untreated alcoholic beverage (12) is illustrated. The apparatus (1) has a receptacle (10) which receives the untreated alcoholic beverage (12), a nano-filtration unit (14) which is in fluid communication with the receptacle (10) and a pump (16) to drive the
10 untreated alcoholic beverage (12) through the nano-filtration unit (14) to produce a retentate (not shown) at a retentate outlet (18) and a raw permeate (not shown) at a raw permeate outlet (20) and an anion exchange column (22) having an inlet (24) which is in fluid communication with the raw permeate outlet (20) of the nano-filtration unit (14) and a treated permeate effluent outlet (26) which is in fluid communication with the retentate
15 outlet (18) which, when the apparatus (1) is in use, combines the retentate (not shown) egressing from the retentate outlet (18) with the treated permeate (not shown) egressing from the treated permeate effluent outlet (26) to provide a treated alcoholic beverage (not shown).

20 One embodiment of the method for treatment of an untreated alcoholic beverage (12) to remove at least one compound (not shown) from the untreated alcoholic beverage (12) includes the steps of subjecting the untreated alcoholic beverage (12) to a process of nano-filtration through the nano-filtration unit (14) to produce a retentate (not shown) and a raw permeate (not shown), with the raw permeate (not shown) containing the compound
25 to be removed from the raw permeate (not shown) followed by treating the raw permeate (not shown) by passage through an anion exchange column under high pH conditions (22) thereby removing at least a portion of the compound (not shown) to provide a treated permeate (not shown); and combining the retentate (not shown) and the treated permeate (not shown) to provide a treated alcoholic beverage.

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It will be appreciated that numerous variations, which will be apparent to those skilled in the art, can be made to the above-mentioned embodiment of the invention without departing from the scope thereof. In particular the means for driving the untreated
5 solution through the nano-filtration unit may be gravity-based.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

1. An apparatus for removing ethyl acetate and acetic acid from an untreated alcoholic beverage comprising:
 - 5 a receptacle for the untreated alcoholic beverage;
 - a nano-filtration means in fluid communication with the receptacle;
 - a means for driving the untreated alcoholic beverage through the nano-filtration means to produce a retentate at a retentate outlet and a raw permeate at a raw permeate outlet, wherein the raw permeate contains an increased concentration of ethyl acetate
 - 10 and acetic acid;
 - an ion exchange column for absorbing ethyl acetate and acetic acid from the raw permeate, the ion exchange column having an inlet which is in fluid communication with the raw permeate outlet of the nano-filtration means and a treated permeate effluent outlet which is in fluid communication with the retentate outlet which, in use, combines
 - 15 the retentate egressing from the retentate outlet with the treated permeate egressing from the treated permeate effluent outlet to provide a treated alcoholic beverage.
2. The apparatus of claim 1 wherein said alcoholic beverage is in said receptacle.
3. The apparatus of claim 1 or claim 2 wherein said alcoholic beverage is wine.
- 20 4. A method for treatment of an untreated alcoholic beverage to remove at least ethyl acetate and acetic acid from said beverage including the steps of subjecting the said beverage to a process of nano-filtration for producing a retentate and a raw permeate, with the raw permeate containing an increased concentration of ethyl acetate and acetic acid; treating the raw permeate in an ion exchange column for removing at least a
- 25 portion of the ethyl acetate and acetic acid to provide a treated permeate; and combining the retentate and the treated permeate to provide a treated alcoholic beverage.
5. A method for treatment of an untreated alcoholic beverage according to claim 4, wherein the treatment of the raw permeate occurs under high pH conditions on an anion exchange column.
- 30 6. The method of claim 4 or claim 5 wherein said alcoholic beverage is wine.

7. A treated alcoholic beverage obtained by the method of claim 4 or claim 5.
8. Wine obtained by the method of claim 6.
9. An apparatus for removing ethyl acetate and acetic acid from an untreated alcoholic beverage, substantially as herein described with reference to any one of the
5 embodiments of the invention illustrated in the accompanying drawings and/or examples.
10. A method for treatment of an untreated alcoholic beverage, substantially as herein described with reference to any one of the embodiments of the invention illustrated in the accompanying drawings and/or examples.
- 10 11. Treated alcoholic beverage, substantially as herein described with reference to any one of the embodiments of the invention illustrated in the accompanying drawings and/or examples

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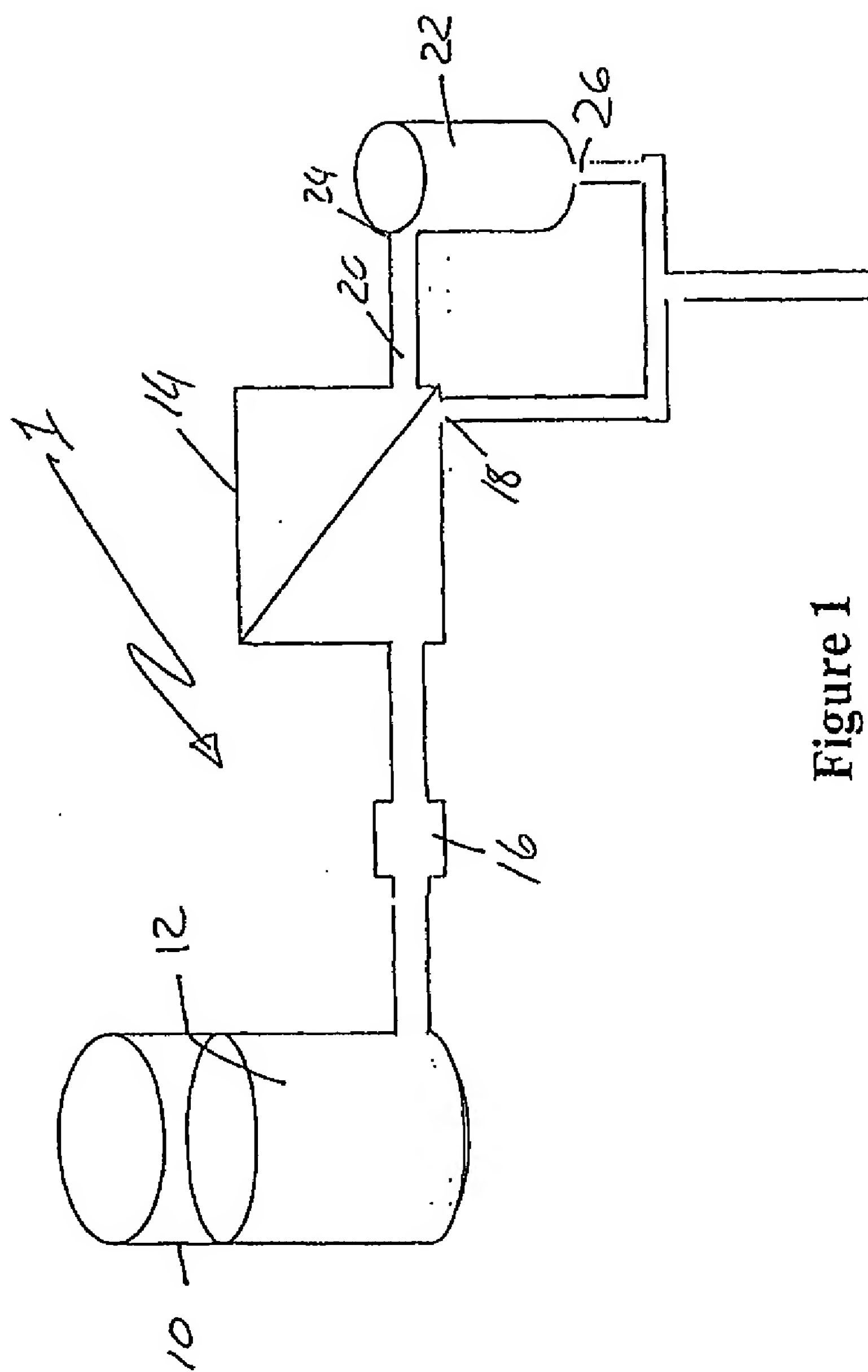


Figure 1